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HARTCROWSER

Earth and Environmental Technologies

Hart Crowser, Inc.
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J-2500

September 11, 1989

Port of Seattle
P.O. Box 1209
Seattle, Washington 98111

Attn: Bob Wells

Re: Oil Seepage Investigation
Short Fill Pond, Terminal 91

Dear Mr. Wells:

This report presents our findings associated with the assessment of oil seepage into the short fill pond (Lake Jacobs) at Terminal 91. The primary goal of this work was to ascertain the source and extent of the oil contamination which has been observed to be seeping into the lagoon. This involved the sampling of subsurface soils through a number of soil borings and installation of monitoring wells in a select number of these borings to assess free product on-site. We also chemically screened soil from the borings to determine the nature of the petroleum product observed. The following presents the results from both field and laboratory work.

SUMMARY OF FINDINGS

The following is a summary of our findings from the work performed at terminal 91:

- Eleven soil borings were advanced to a depth of approximately 20 feet and petroleum odor was detected in all borings with the exception of B-4;
- Chemical screening using Gas Chromatography/Flame Ionization Detection (GC/FID) revealed that the petroleum product found on the site was diesel;
- Four monitoring wells were installed on the site and diesel was measured to a depth of one foot in the well closest to the southwest corner of lagoon. Free product was not measured in the other three wells; and
- No priority pollutant organic compounds were detected in soil samples obtained from soil borings on the site.

SOIL SAMPLING AND ANALYSIS

Site Utility and Buried Pipe Investigation

Hart Crowser representatives completed a thorough review of the Port of Seattle's files to determine the presence of buried utilities and underground pipes on the site prior to starting field activities. On July 14, 1989, an on-site

reconnaissance was also performed in conjunction with a private utility locating company, Locators, Inc., to confirm the locations for drilling of soil borings and monitoring wells. The City of Seattle and Washington Natural Gas were also contacted for information on potential buried utilities.

Soil Borings

Soil borings were advanced on the site using a truck-mounted hollow-stem auger. Eleven soil borings were advanced on the site at the locations shown on Figure 1. Borings ranged from 18 to 20 feet in depth.

Soil samples were obtained using a split-barrel sampler following the standard penetration resistance method, (ASTM D 1586). Samples were collected at 2.5-foot-depth intervals. Logs for each soil boring are shown on Figures 3 through 14. Figure 2 presents a key to the logs.

Representative samples were taken from each depth interval and placed in appropriate jars for chemical analyses as described below.

Chemical Analysis

All soil samples were screened initially using an H-Nu photoionization detector to measure the presence of volatile organics in the soil. Samples were then screened for specific fuel mixtures using a Gas Chromatograph coupled with a Flame Ionization Detector (GC/FID). The method used

in this screening technique involves an initial extraction of the sample with a hexane/methylene chloride mixture and subsequent analysis of the extract using GC/FID. Samples were initially identified as diesel and a diesel sample obtained from the PNWOCO facility at terminal 91 was used as a standard to quantify the extracts. The results from both the H-Nu and GC/FID screening are presented in Table 1.

Six samples were selected and sent to Analytical Technologies, Inc., (ATI) in Renton, Washington, for confirmation of petroleum screening and for analysis of a more detailed list of priority pollutant compounds including volatile and semivolatile organic compounds by Gas Chromatography/Mass Spectrometry (GC/MS). The results for these analyses are presented in Table 2.

MONITORING WELL INSTALLATION

A total of four groundwater monitoring wells were installed on the site. These wells were completed in soil borings B-2, B-3, B-6, and B-11 as shown on Figure 1. The wells were approximately 20 feet in depth and were screened across the water table which was encountered at about nine feet across the site.

The monitoring wells were completed using 2-inch-diameter, schedule 40, threaded PVC casings and a 5-foot-long screened section of 0.02-inch slotted PVC. A threaded end cap was used at the bottom of the well. Sand pack and a bentonite grout were placed around the casing as the auger sections

were retrieved from the borehole. At the ground surface a flush-mount monument was secured in concrete to protect the well from damage. Figures 4, 5, 8, and 13 show the details of these well constructions.

Approximately two days after installation, the wells were developed to remove disturbed fine-grained sediments from the surrounding formation and the PVC casing. Development was performed using PVC bailers and approximately 5 casing volumes of water were removed.

Depth to water and measurement of any free product present in the wells were performed the day after development and then again three weeks later. These measurements were performed using a battery operated flexidip meter.

FIELD AND LABORATORY QUALITY CONTROL

Equipment Decontamination

Truck-mounted drilling equipment was steam cleaned between borings. Other sampling equipment was cleaned with detergent solutions and multiple washings with deionized water. All wash water was collected in 55-gallon drums and stored on site.

Laboratory QA/QC

Laboratory quality control consisted of field and analytical duplicates, matrix spike and matrix spike duplicate

analyses, and surrogate recovery analyses. Results from these analyses were all within established laboratory control limits and all data received from the laboratory were found acceptable for inclusion in this report.

FINDINGS

Soil samples collected from borings ranged from very gravelly sand at the surface to slightly silty sand at depths with zones of cobbles near the surface across most of the site and wood fragments in the northeast portion of the site.

The depth to water was generally at nine to ten feet beneath most of the site. Free product was measured to a depth of approximately 1 foot in monitoring well B-3. Although a strong petroleum odor was detected in the other monitoring wells, no free product was measured in these wells.

A strong petroleum odor was encountered in all of the soil borings, with the exception of B-4, at about seven to eight feet. Boring B-4, which was located on the eastern side of the bulkhead which ran along the western side of the slip between terminal 90 and 91, did not contain measurable quantities of diesel. GC/FID screen data indicated that diesel was the fuel present on the site at concentrations ranging from less than 25 mg/kg (ppm) at the surface in all borings to 21,000 mg/kg at a depth of nine feet in Boring B-2. The highest concentrations occurred just above the water table in most of the borings with the highest

concentrations found in the southeastern portion of the site. Table 1 contains the concentrations of diesel at each depth interval for each boring.

Samples sent to ATI for further analyses confirmed the presence and concentrations of diesel as determined by the GC/FID screen. No priority pollutant volatile or semivolatile organic compounds were detected in two soil samples analyzed by Gas Chromatography/Mass Spectrometry. The results of these analyses are presented in Table 2.

CONCLUSIONS AND RECOMMENDATIONS

The extent of the contamination encompasses the majority of the area sampled during this work. The contamination is bounded on the east side of the site by an existing bulkhead, although it appears that the product observed in the lagoon is a result of product leaking underneath or through this bulkhead. To more adequately determine the extent of contamination, additional borings and monitoring wells should be installed in the area south along pier 91. Boring B-4, which was located on the eastern side of

The source of diesel has not been determined. Leakage from the existing PNWOCO diesel lines is still a possibility. Abandoned pipelines are a potential source as well, however, the location of the old pipes on the site is unknown. We recommend the use of ground-penetrating-radar (GPR) to identify if any old lines are present near the detected product.

Product recovery from the existing well containing free product (B-3) should be initiated soon. Initial pumping tests from this well and from B-2 can provide information on the extent of free product present on the site. A more extensive recovery system can be installed after this information is obtained as well as further data regarding the extent and source of contamination.

We hope this report meets your needs at this time. If you have any questions or comments please call.

Sincerely,

HART CROWSER, INC.

LISA F. LEFKOVITZ
Environmental Chemist

PHILIP A. SPADARO
Sr. Project Env. Chemist

LFL/PAS:cmr/jal
LR2500A/JOBS

Attachments:
Table 1 - Chemical Screening Results
Table 2 - Priority Pollutant Results
Figure 1 - Site and Exploration Plan
Figure 2 - Key to Exploration Logs
Figures 3 through 13 - Boring Log B-1 through B-11 (includes monitoring well construction logs for B-2, B-3, B-6, and B-11)

Table 1 – Chemical Screening Results

Location (date sampled)	Sample Number	Depth in feet	HNu in ppm	GC/FID Screen in mg/kg	ATI GC/FID in mg/kg	Comments
B-1 7/18	S-1	7.5	75	18000		diesel
	S-2	10	75	14000		diesel
	S-3	12.5	100	4300		diesel
	S-4	15	90	4200		diesel
	S-5	17.5	40	313	230	diesel
	S-6	20	9	<25		
B-2 7/18	S-1	2.5	<1	NA		
	S-2	5	<1	NA		
	S-3	7.5	68	21000		diesel
	S-4	10	76	17000		diesel
	S-5	12.5	86	1900		diesel
	S-6	15	28	300		diesel
	S-7	17.5	24	140		bunker
B-3 7/19	S-1	2.5	<1	230		diesel
	S-2	7.5	62	8000		diesel
	S-3	10	91	15000		diesel
	S-4	12.5	50	390		diesel
	S-5	15	70	490		diesel
	S-6	17.5	60	510		diesel
B-4 7/19	S-1	2.5	<1	370		diesel
	S-2	5	5	NA		
	S-3	7.5	<1	NA		
	S-4	10	<1	<25		
	S-5	12.5	<1	NA		
	S-6	15	<1	<25		
	S-7	17.5	<1	NA		
B-5 7/21	S-1	5		<25		
	S-2	7.5		15000		diesel
	S-3	10		7300	6700	diesel
	S-4	12.5		1100		diesel
	S-5	15		340		diesel
	S-6	17.5		480		diesel
B-6 7/20	S-1	2.5	1	NA		
	S-2	5	<1	<25		
	S-3	10	66	13000		diesel
	S-4	12.5	10	NA		
	S-5	15	24	500		diesel
	S-6	18.5	32	400		diesel

Table 1 – Chemical Screening Results

Location (date sampled)	Sample Number	Depth in feet	HNu in ppm	GC/FID Screen in mg/kg	ATI GC/FID in mg/kg	Comments
B-7 7/20	S-1	2.5	<1	NA		
	S-2	5	<1	<25		
	S-3	7.5	52	3300		diesel
	S-4	10	56	7900	8700	diesel
	S-5	12.5	26	160		diesel
	S-6	15.5	9	NA		
	S-7	17.5	5	<25		
B-8 7/20	S-1	2.5	<1	NA		
	S-2	7.5	50-120?	5500	4800	diesel
	S-3	10	62	12000		diesel
	S-4	12.5	25	290		diesel
	S-5	15	24	NA		
	S-6	17.5	18	99		diesel
B-9 7/20	S-1	2.5	<1	NA		
	S-2	5	<1	NA		
	S-3	7.5	<1	330		bunker
	S-4	12.5	20	220		diesel
	S-5	15	24	250		diesel
	S-6	17.5	32	570		diesel
B-10 7/20	S-1	2.5	<1	<25		
	S-2	5	3	<25		
	S-3	7.5	1	NA	77	diesel
	S-4	10	40	4900		diesel
	S-5	12.5	12	NA		
	S-6	15	11	NA		
	S-7	17.5	5	<25		
B-11 7/20	S-1	2.5	<1	<25		
	S-2	5	<1	NA		
	S-3	7.5	2	79		unknown
	S-4	10	26	NA	6400	diesel
	S-5	12.5	24	1000		diesel
	S-6	15	14	NA		
	S-7	17.5	7	<25		

Table 2 – Chemical Results from Analytical Technologies, Inc.

Sample:		B-1, S-5	B-7, S-3	B-3, S-4
A.T.I. #:		8907-200-5	8907-200-7	8907-200-8
VOLATILE ORGANICS				
Acetone	mg/Kg	NA	<1.0	<1.0
Benzene	mg/Kg	NA	<0.05	<0.05
Bromodichloromethane	mg/Kg	NA	<0.05	<0.05
Bromoform	mg/Kg	NA	<0.3	<0.3
Bromomethane	mg/Kg	NA	<0.5	<0.5
2-Butanone	mg/Kg	NA	<0.5	<0.5
Carbon Disulfide	mg/Kg	NA	<0.05	<0.05
Carbon Tetrachloride	mg/Kg	NA	<0.05	<0.05
Chlorobenzene	mg/Kg	NA	<0.05	<0.05
Chloroethane	mg/Kg	NA	<0.05	<0.05
Chloroform	mg/Kg	NA	<0.5	<0.5
Chloromethane	mg/Kg	NA	<0.05	<0.05
Dibromochloromethane	mg/Kg	NA	<0.05	<0.05
1,1-Dichloroethane	mg/Kg	NA	<0.05	<0.05
1,2-Dichloroethane	mg/Kg	NA	<0.05	<0.05
1,1-Dichloroethene	mg/Kg	NA	<0.05	<0.05
trans-1,2-Dichloroethene	mg/Kg	NA	<0.05	<0.05
1,2-Dichloropropane	mg/Kg	NA	<0.05	<0.05
cis-1,3-Dichloropropene	mg/Kg	NA	<0.05	<0.05
trans-1,3-Dichloropropene	mg/Kg	NA	<0.05	<0.05
Ethylbenzene	mg/Kg	NA	<0.05	<0.05
2-Hexanone	mg/Kg	NA	<0.5	<0.5
4-Methyl-2-Pentanone	mg/Kg	NA	<0.5	<0.5
Methylene Chloride	mg/Kg	NA	<0.3	<0.3
Styrene	mg/Kg	NA	<0.05	<0.05
1,1,2,2-Tetrachloroethane	mg/Kg	NA	<0.05	<0.05
Tetrachloroethene	mg/Kg	NA	<0.05	<0.05
Toluene	mg/Kg	NA	<0.05	<0.05
1,1,1-Trichloroethane	mg/Kg	NA	<0.05	<0.05
1,1,2-Trichloroethane	mg/Kg	NA	<0.05	<0.05
Trichloroethene	mg/Kg	NA	<0.05	<0.05
Vinyl Acetate	mg/Kg	NA	<0.5	<0.5
Vinyl Chloride	mg/Kg	NA	<0.05	<0.05
Total Xylenes	mg/Kg	NA	<0.05	<0.05

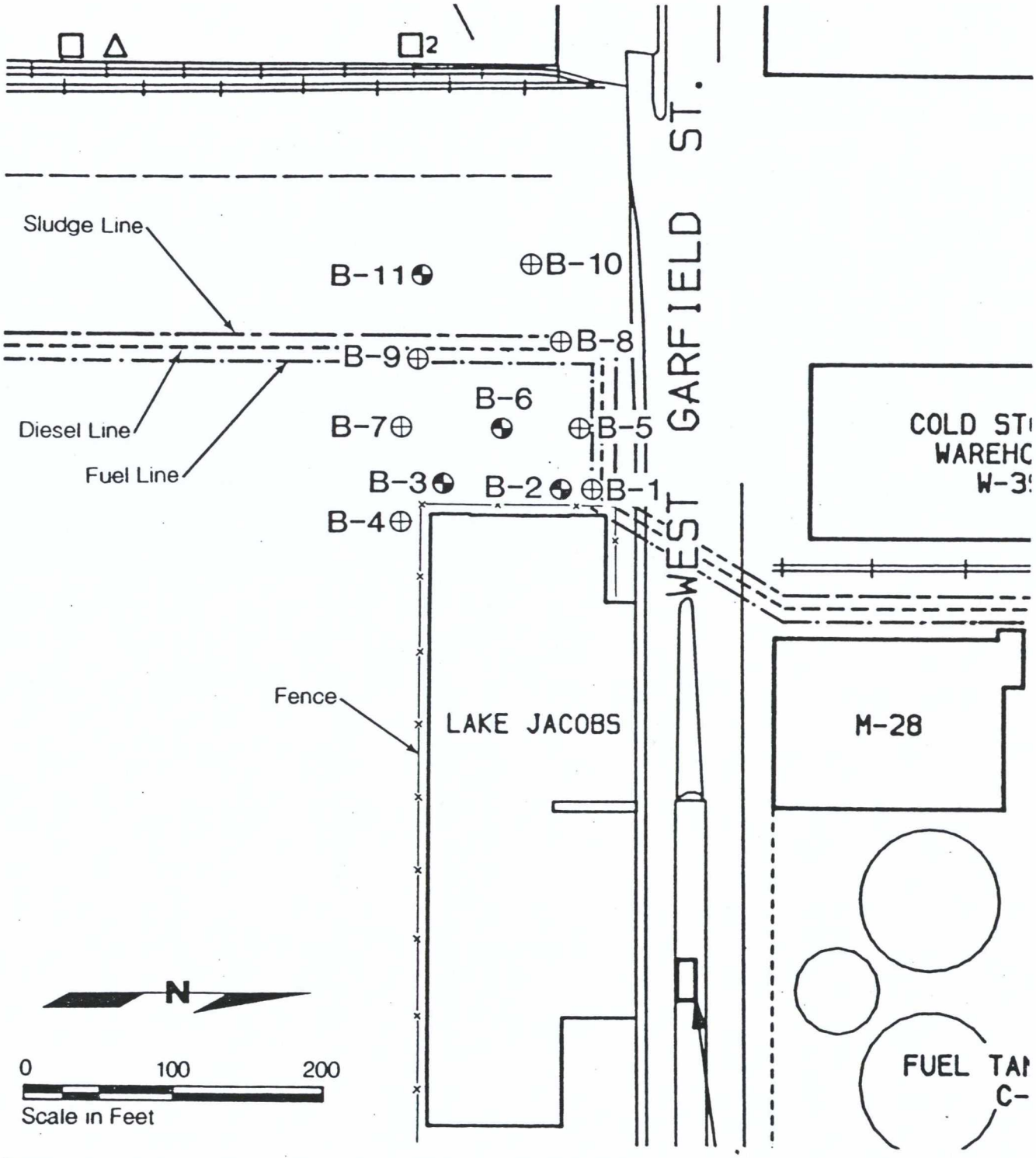
Table 2 – Chemical Results from Analytical Technologies, Inc.

Sample:		B-1, S-5	B-7, S-3	B-3, S-4
A.T.I. #:		8907-200-5	8907-200-7	8907-200-8
SEMIVOLATILE ORGANICS				
N-Nitrosodimethylamine	mg/Kg	<0.17		
Phenol	mg/Kg	<0.17	NA	NA
Aniline	mg/Kg	<0.17	NA	NA
Bis(2-chloroethyl)ether	mg/Kg	<0.17	NA	NA
2-Chlorophenol	mg/Kg	<0.17	NA	NA
1,3-Dichlorobenzene	mg/Kg	<0.17	NA	NA
1,4-Dichlorobenzene	mg/Kg	<0.17	NA	NA
Benzyl Alcohol	mg/Kg	<0.17	NA	NA
1,2-Dichlorobenzene	mg/Kg	<0.17	NA	NA
2-Methylphenol	mg/Kg	<0.17	NA	NA
Bis(2-chloroisopropyl)ether	mg/Kg	<0.17	NA	NA
4-Methylphenol	mg/Kg	<0.17	NA	NA
N-Nitroso-di-n-propylamine	mg/Kg	<0.17	NA	NA
Hexachloroethane	mg/Kg	<0.17	NA	NA
Nitrobenzene	mg/Kg	<0.17	NA	NA
Isophorone	mg/Kg	<0.17	NA	NA
2-Nitrophenol	mg/Kg	<0.17	NA	NA
2,4-Dimethylphenol	mg/Kg	<0.17	NA	NA
Benzoic Acid	mg/Kg	<0.85	NA	NA
Bis(2-chloroethoxy)methane	mg/Kg	<0.17	NA	NA
2,4-Dichlorophenol	mg/Kg	<0.17	NA	NA
1,2,4-Trichlorobenzene	mg/Kg	<0.17	NA	NA
Naphthalene	mg/Kg	<0.17	NA	NA
4-Chloroaniline	mg/Kg	<0.17	NA	NA
Hexachlorobutadiene	mg/Kg	<0.17	NA	NA
4-Chloro-3-methylphenol	mg/Kg	<0.17	NA	NA
2-Methylnaphthalene	mg/Kg	<0.17	NA	NA
Hexachlorocyclopentadiene	mg/Kg	<0.17	NA	NA
2,4,6-Trichlorophenol	mg/Kg	<0.17	NA	NA
2,4,5-Trichlorophenol	mg/Kg	<0.85	NA	NA
2-Chloronaphthalene	mg/Kg	<0.17	NA	NA
2-Nitroaniline	mg/Kg	<0.85	NA	NA
Dimethyl phthalate	mg/Kg	<0.17	NA	NA
Acenaphthylene	mg/Kg	<0.17	NA	NA
3-Nitroaniline	mg/Kg	<0.85	NA	NA
Acenaphthene	mg/Kg	<0.17	NA	NA
2,4-Dinitrophenol	mg/Kg	<0.85	NA	NA
4-Nitrophenol	mg/Kg	<0.85	NA	NA
Dibenzofuran	mg/Kg	<0.17	NA	NA
2,4-Dinitrotoluene	mg/Kg	<0.17	NA	NA

Table 2 – Chemical Results from Analytical Technologies, Inc.

Sample:		B-1, S-5	B-7, S-3	B-3, S-4
A.T.I. #:		8907-200-5	8907-200-7	8907-200-8
2,6-Dinitrotoluene	mg/Kg	<0.17	NA	NA
Diethyl phthalate	mg/Kg	<0.17	NA	NA
4-Chlorophenyl phenylether	mg/Kg	<0.17	NA	NA
Fluorene	mg/Kg	<0.17	NA	NA
4-Nitroaniline	mg/Kg	<0.85	NA	NA
4,6-Dinitro-2-methylphenol	mg/Kg	<0.85	NA	NA
N-Nitrosodiphenylamine	mg/Kg	<0.17	NA	NA
4-Bromophenyl phenylether	mg/Kg	<0.17	NA	NA
Hexachlorobenzene	mg/Kg	<0.17	NA	NA
Pentachlorophenol	mg/Kg	<0.85	NA	NA
Phenanthrene	mg/Kg	<0.17	NA	NA
Anthracene	mg/Kg	<0.17	NA	NA
Di-n-butyl phthalate	mg/Kg	<0.17	NA	NA
Fluoranthene	mg/Kg	<0.17	NA	NA
Benzidine	mg/Kg	<1.7	NA	NA
Pyrene	mg/Kg	<0.17	NA	NA
Butylbenzylphthalate	mg/Kg	<0.17	NA	NA
3,3'-Dichlorobenzidine	mg/Kg	<0.34	NA	NA
Benzo(a)anthracene	mg/Kg	<0.17	NA	NA
Bis(2-ethylhexyl)phthalate	mg/Kg	<0.17	NA	NA
Chrysene	mg/Kg	<0.17	NA	NA
Di-n-octyl phthalate	mg/Kg	<0.17	NA	NA
Benzo(b)fluoranthene	mg/Kg	<0.17	NA	NA
Benzo(k)fluoranthene	mg/Kg	<0.17	NA	NA
Benzo(a)pyrene	mg/Kg	<0.17	NA	NA
Indeno(1,2,3-cd)pyrene	mg/Kg	<0.17	NA	NA
Dibenzo(a,h)anthracene	mg/Kg	<0.17	NA	NA
Benzo(g,h,i)perylene	mg/Kg	<0.17	NA	NA

Site and Exploration Plan



Base map prepared from drawing provided by the Port of Seattle, entitled "Marine Facilities Terminal 91 (South)", dated December 16, 1989.

B-1 ⊕ Boring Location and Number

B-2 ◒ Monitoring Well Location and Number

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Figure 1

Key to Exploration Logs

Sample Descriptions

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance. Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 - 4	Very soft	0 - 2	<0.125
Loose	4 - 10	Soft	2 - 4	0.125 - 0.25
Medium dense	10 - 30	Medium stiff	4 - 8	0.25 - 0.5
Dense	30 - 50	Stiff	8 - 15	0.5 - 1.0
Very dense	>50	Very stiff	15 - 30	1.0 - 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptible moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 - 5
Slightly (clayey, silty, etc.)	5 - 12
Clayey, silty, sandy, gravelly	12 - 30
Very (clayey, silty, etc.)	30 - 50

Legends

Sampling

BORING SAMPLES

- Split Spoon
- Shelby Tube
- Cuttings
- Core Run
- * No Sample Recovery
- P Tube Pushed, Not Driven

Test Symbols

GS	Grain Size Classification
CN	Consolidation
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained
QU	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits

Water Content in Percent
- Liquid Limit
- Natural
- Plastic Limit

Ground Water Observations

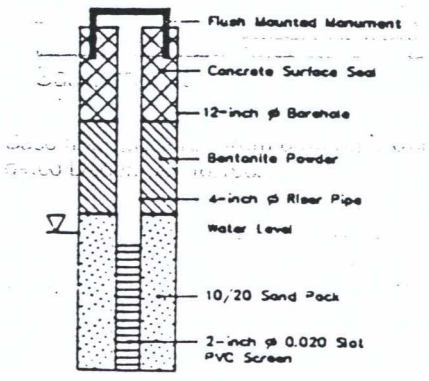

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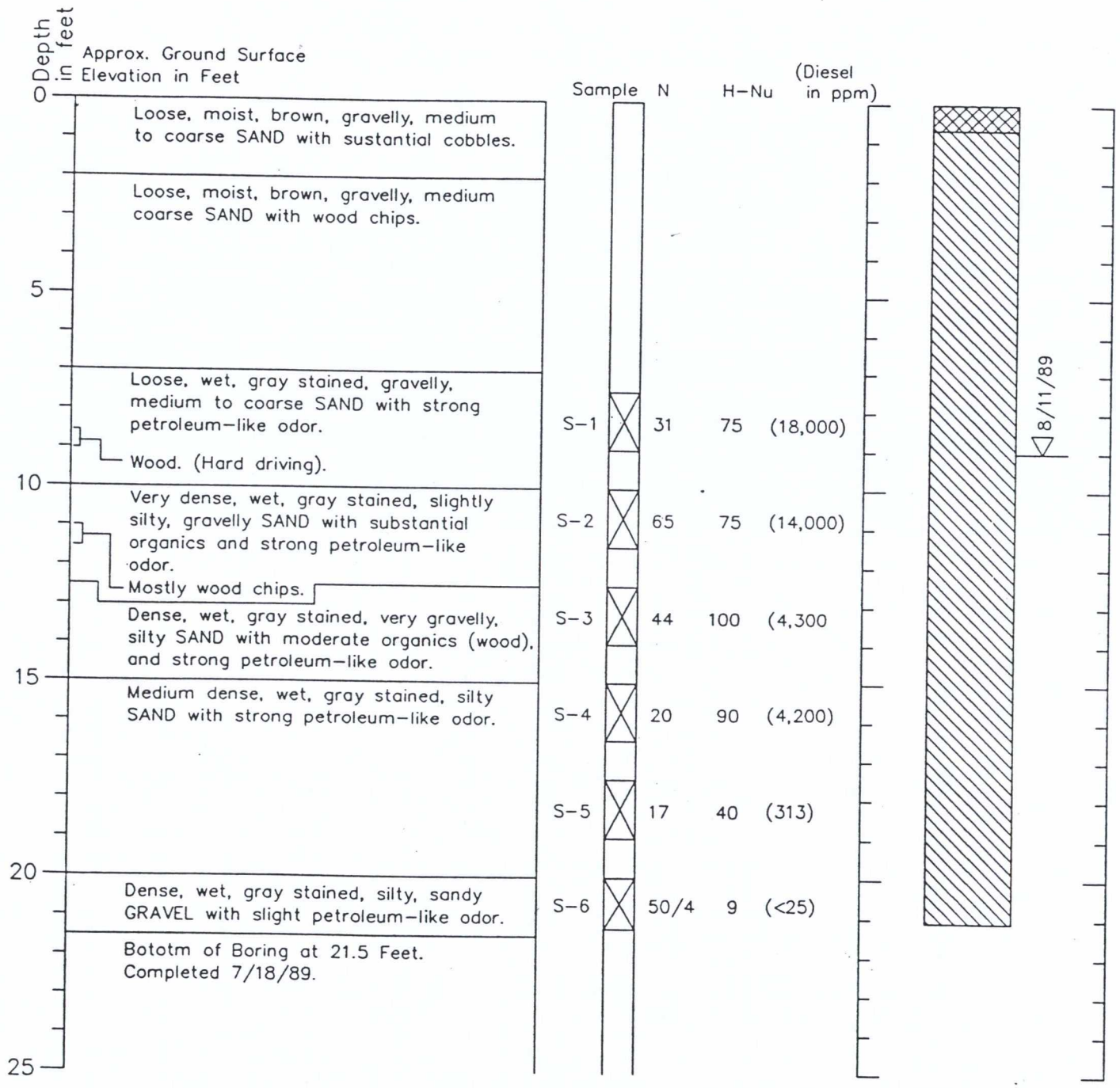
Figure 2

Boring Log B-1

Geologic Log



1. Refer to Figure 2 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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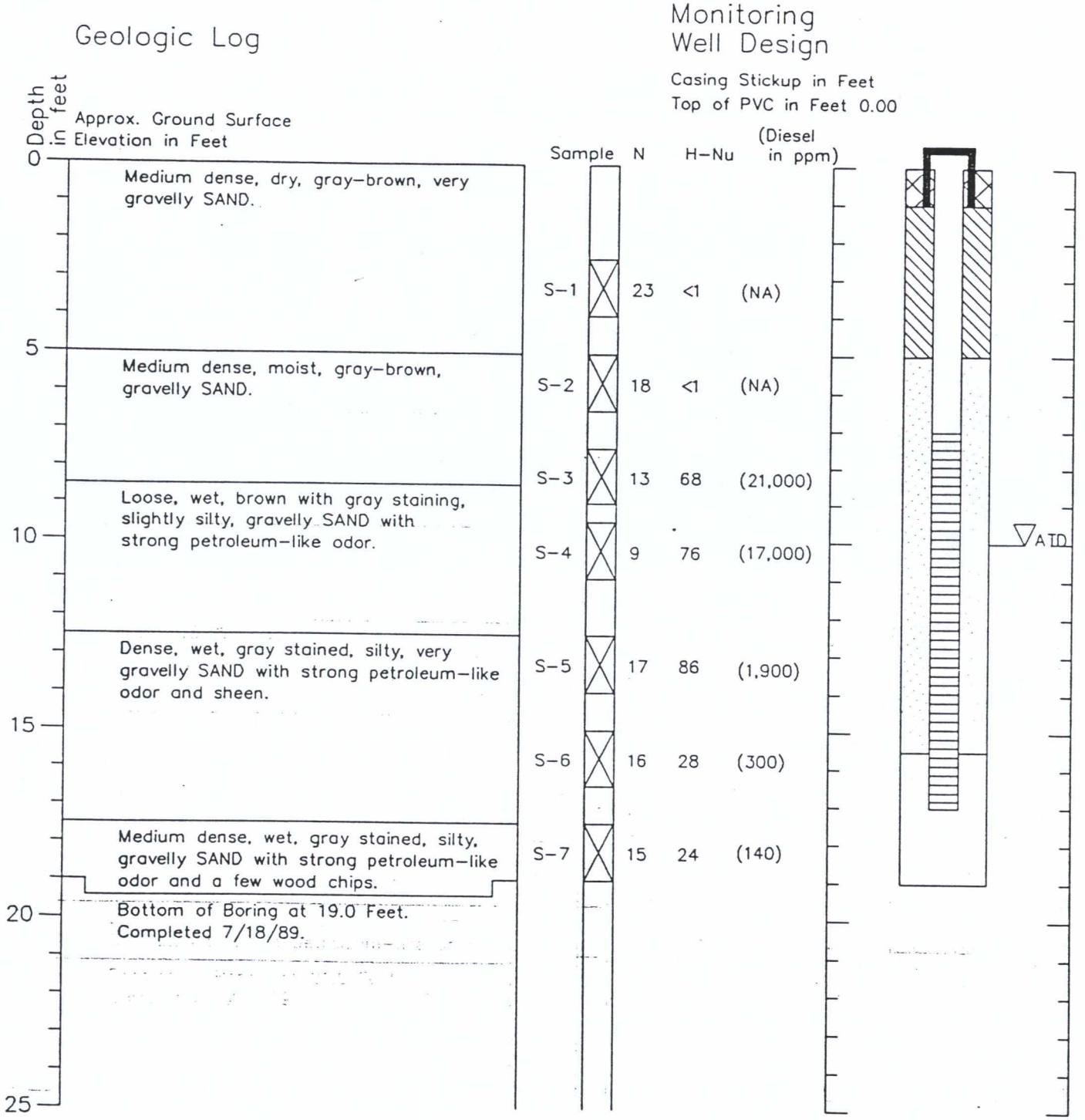
Figure 3

Boring Log and Construction Data for Monitoring Well B-2



1. Refer to Figure 2 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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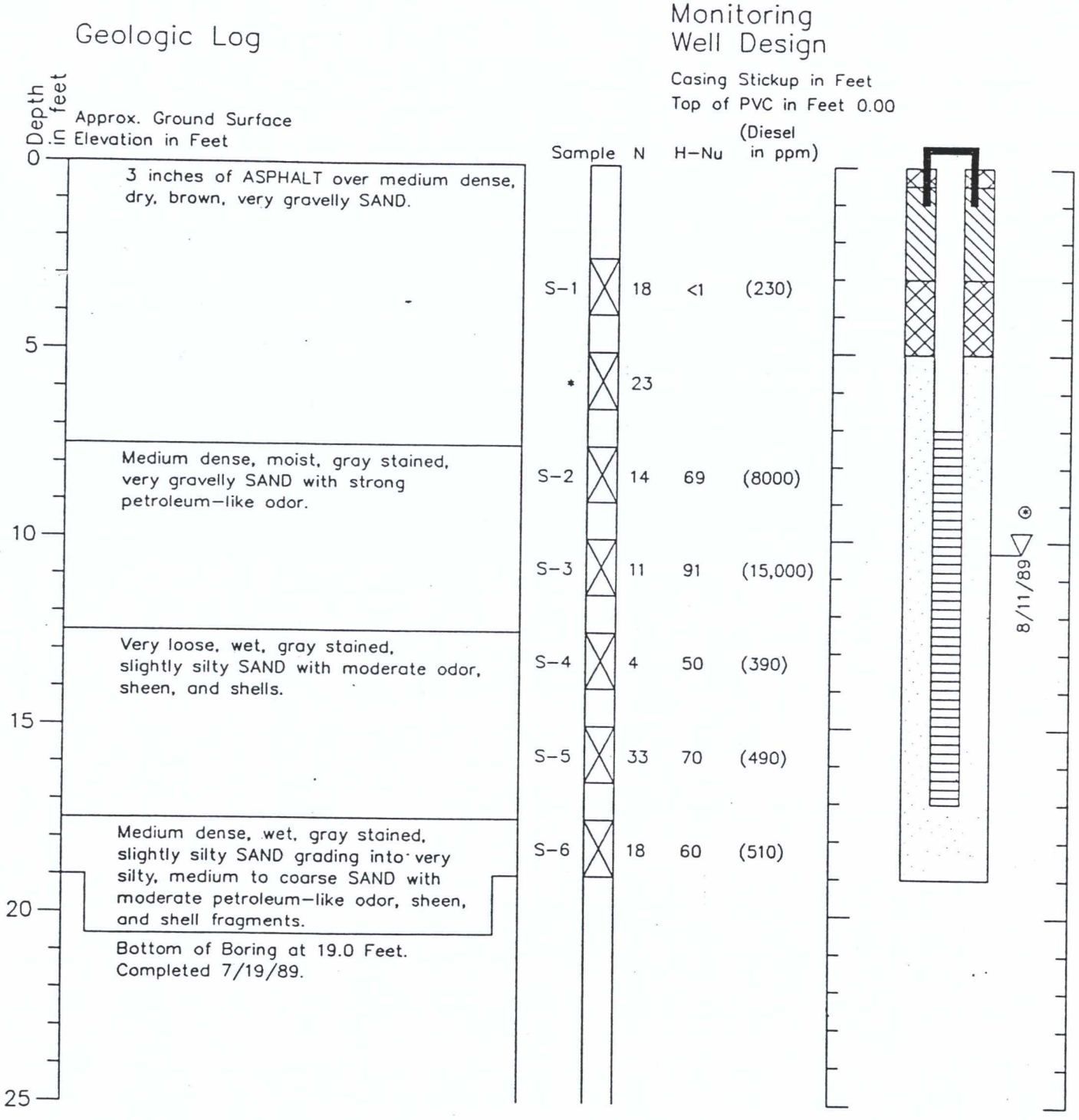
Figure 4

Boring Log and Construction Data for Monitoring Well B-3



1. Refer to Figure 2 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

⊛ Depth to free product at 9.4 feet.

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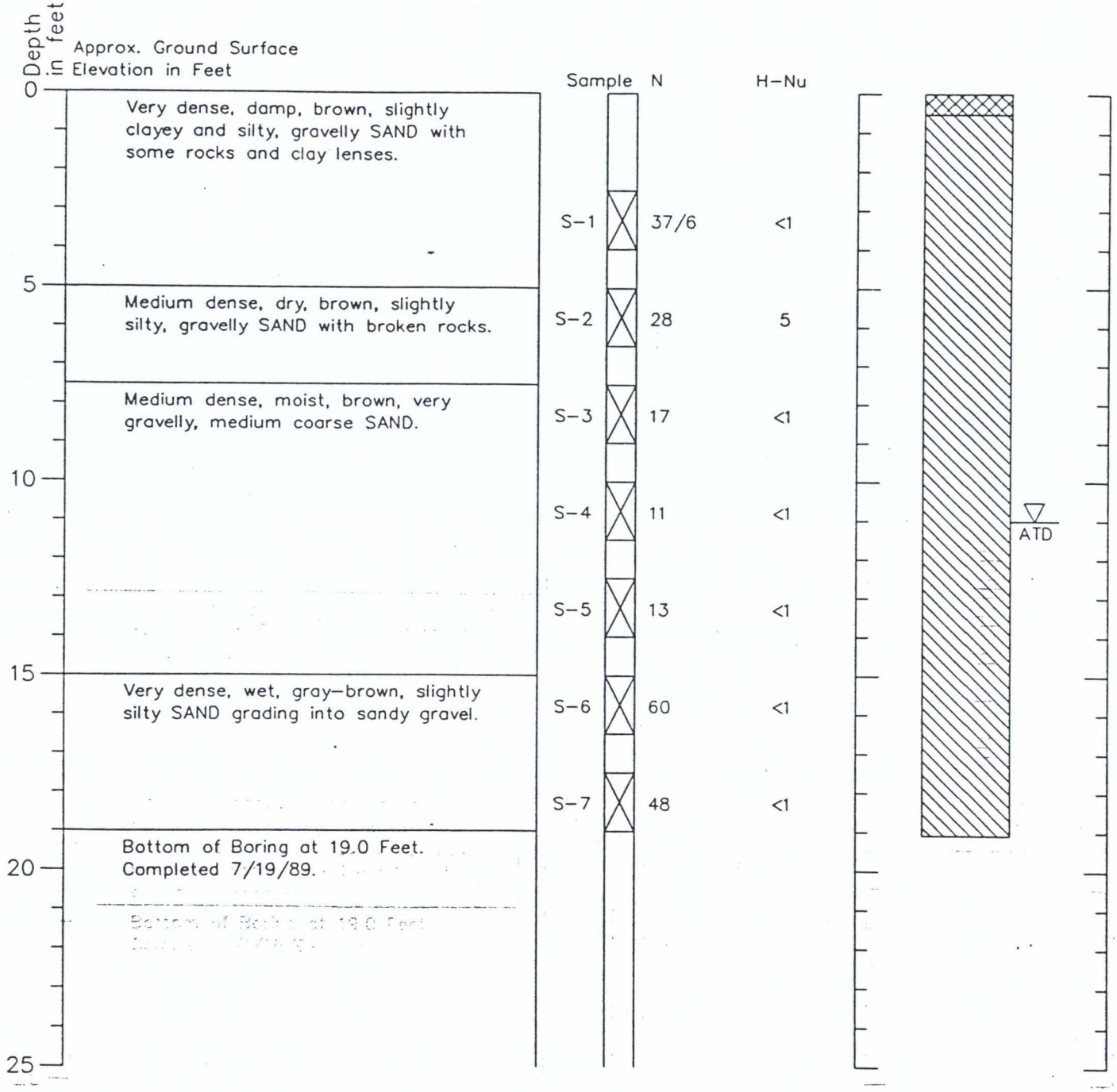
Figure 5

Boring Log B-4

Geologic Log



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2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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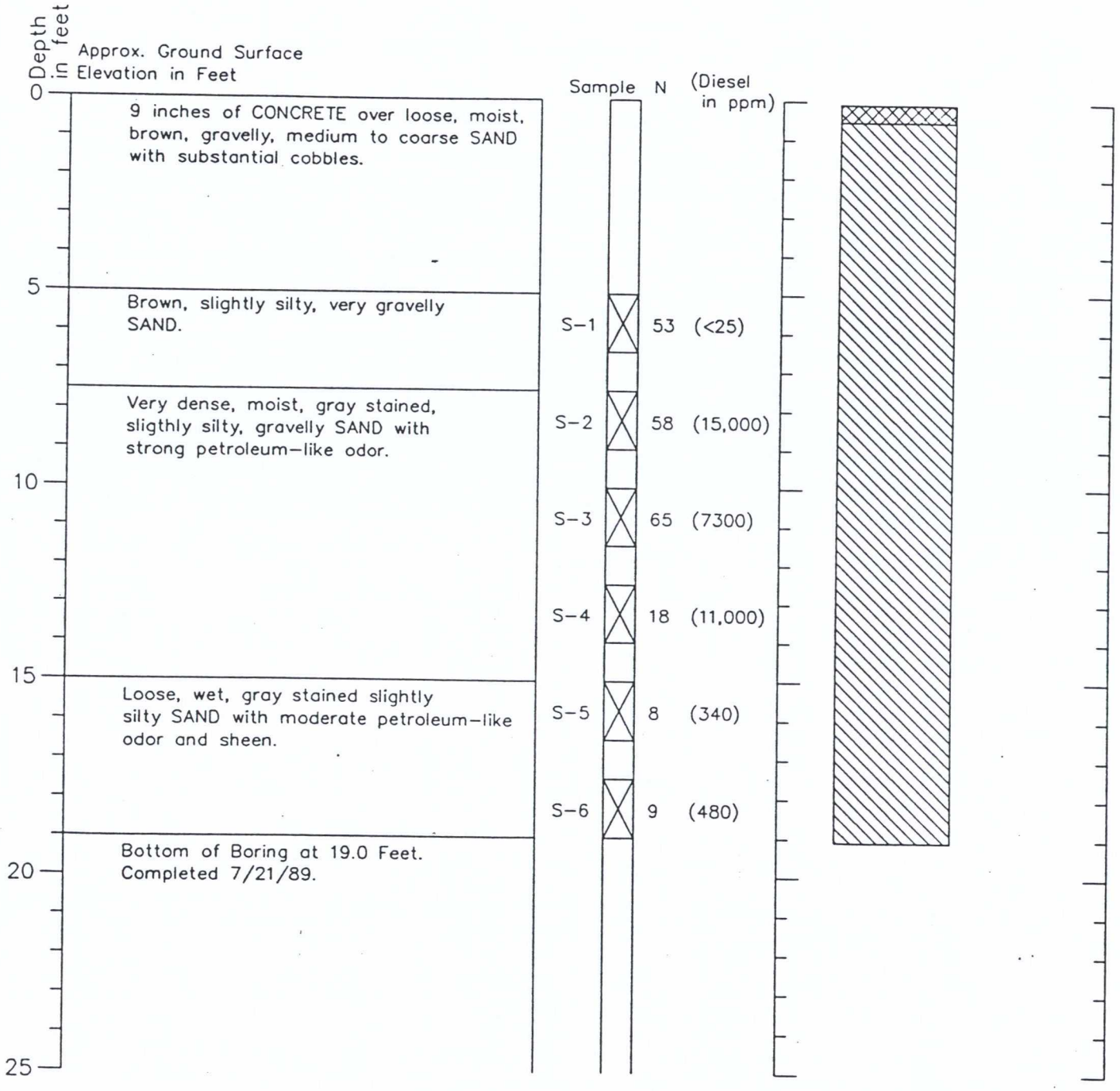
Figure 6

Boring Log B-5

Geologic Log



1. Refer to Figure 2 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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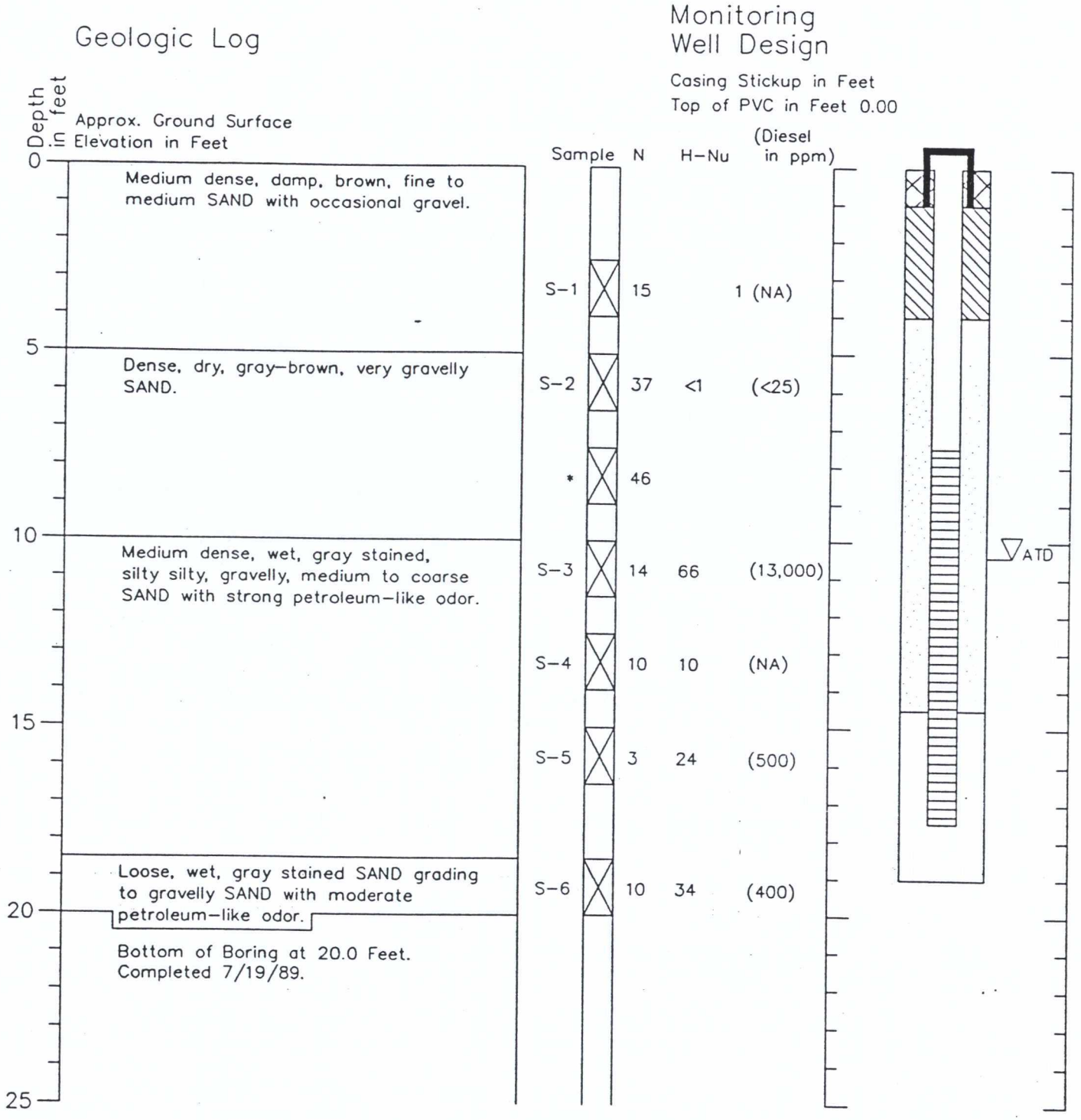
Figure 7

Boring Log and Construction Data for Monitoring Well B-6



1. Refer to Figure 2 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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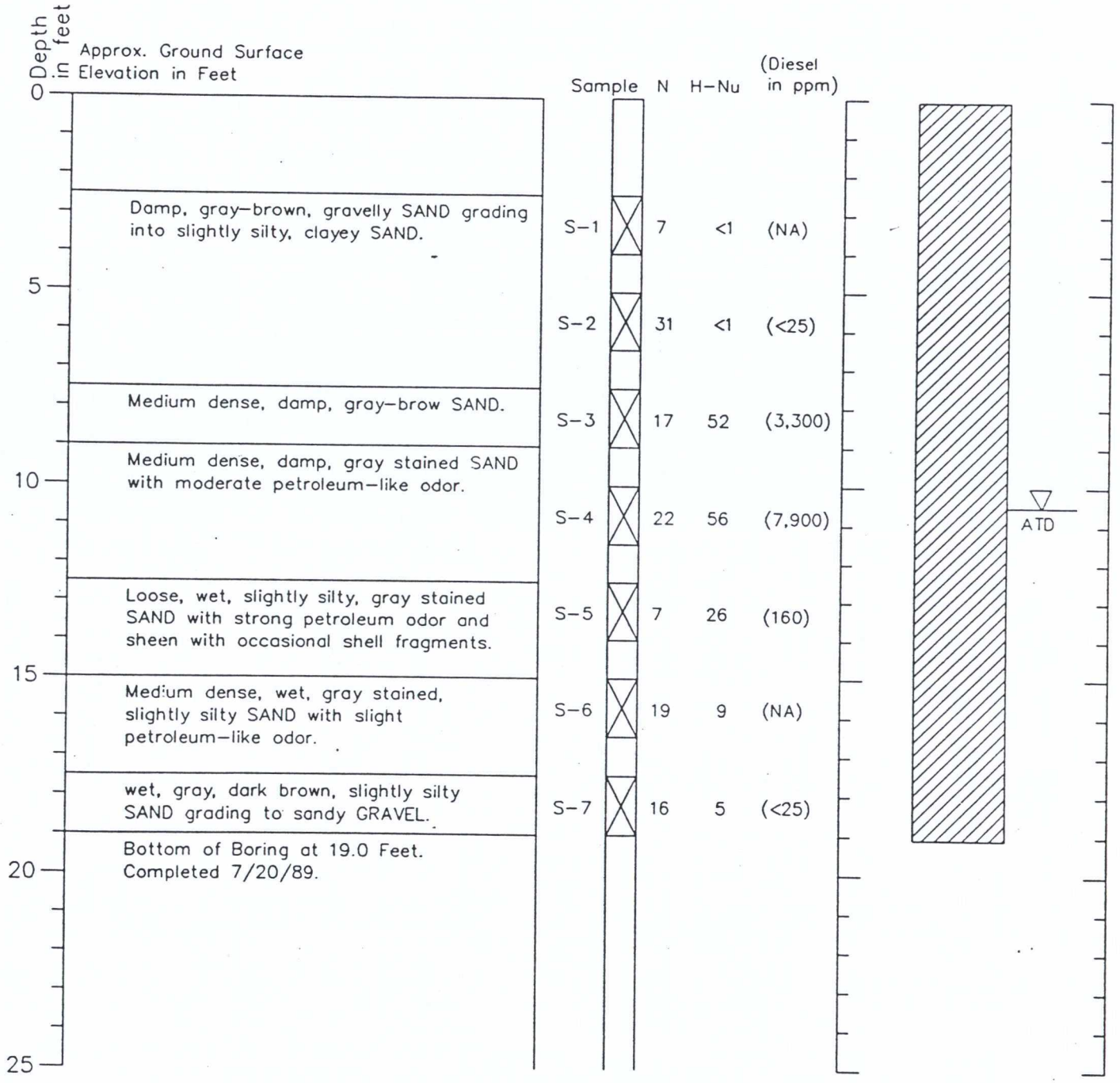
Figure 8

Boring Log B-7

Geologic Log



1. Refer to Figure 2 for explanation on descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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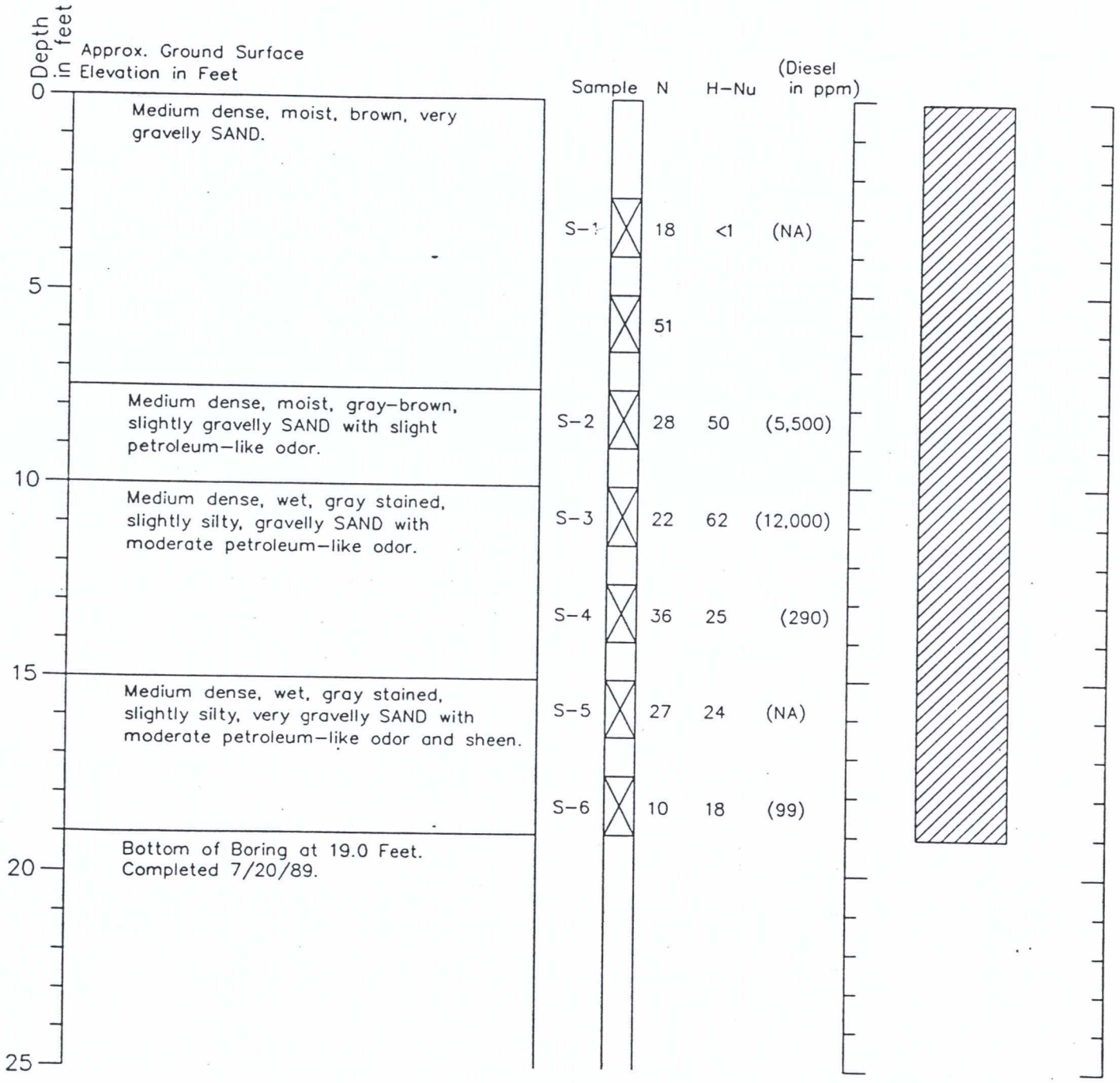
Figure 9

Boring Log B-8

Geologic Log



1. Refer to Figure 2 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
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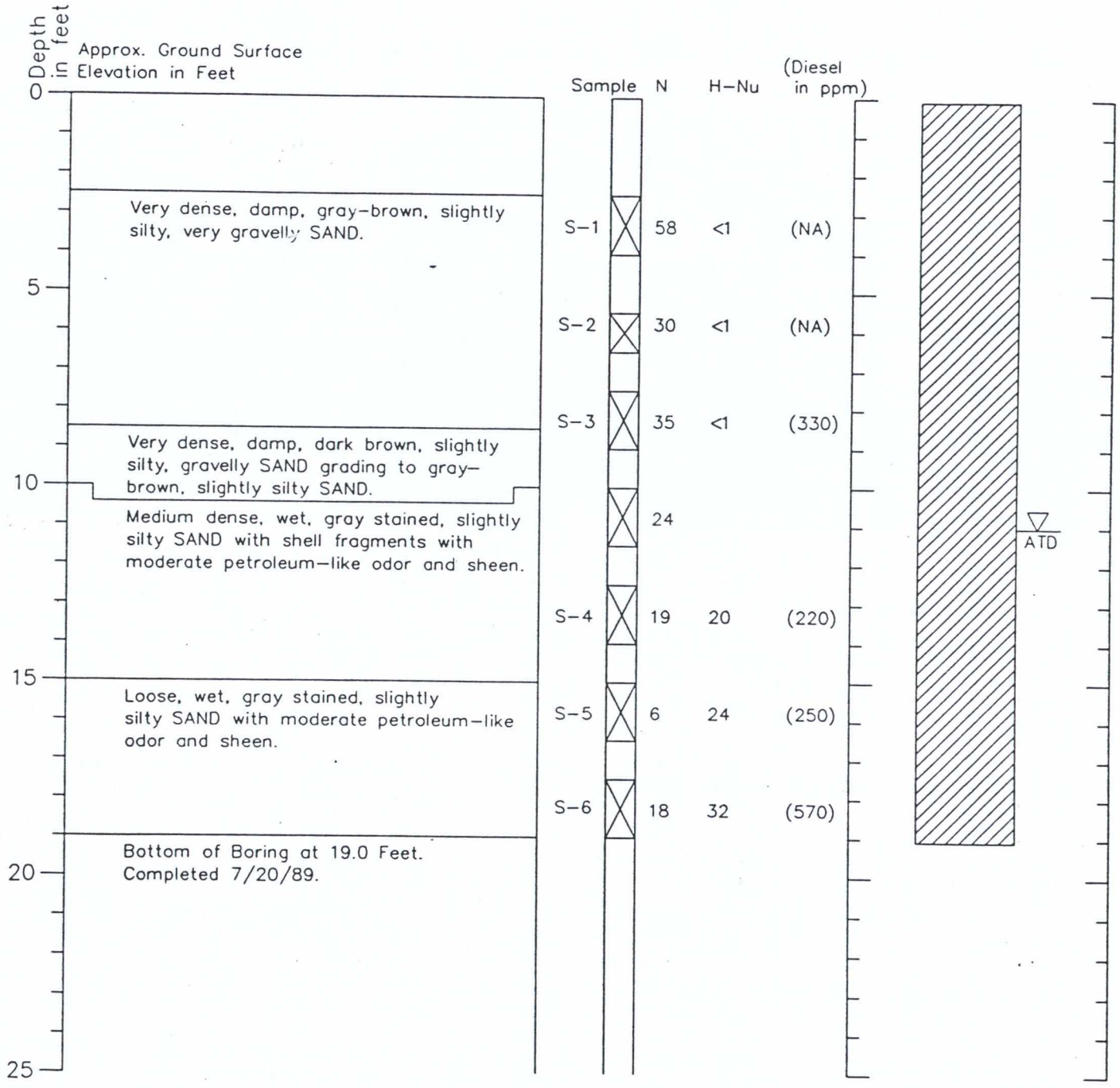
Figure 10

Boring Log B-9

Geologic Log



1. Refer to Figure 2 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
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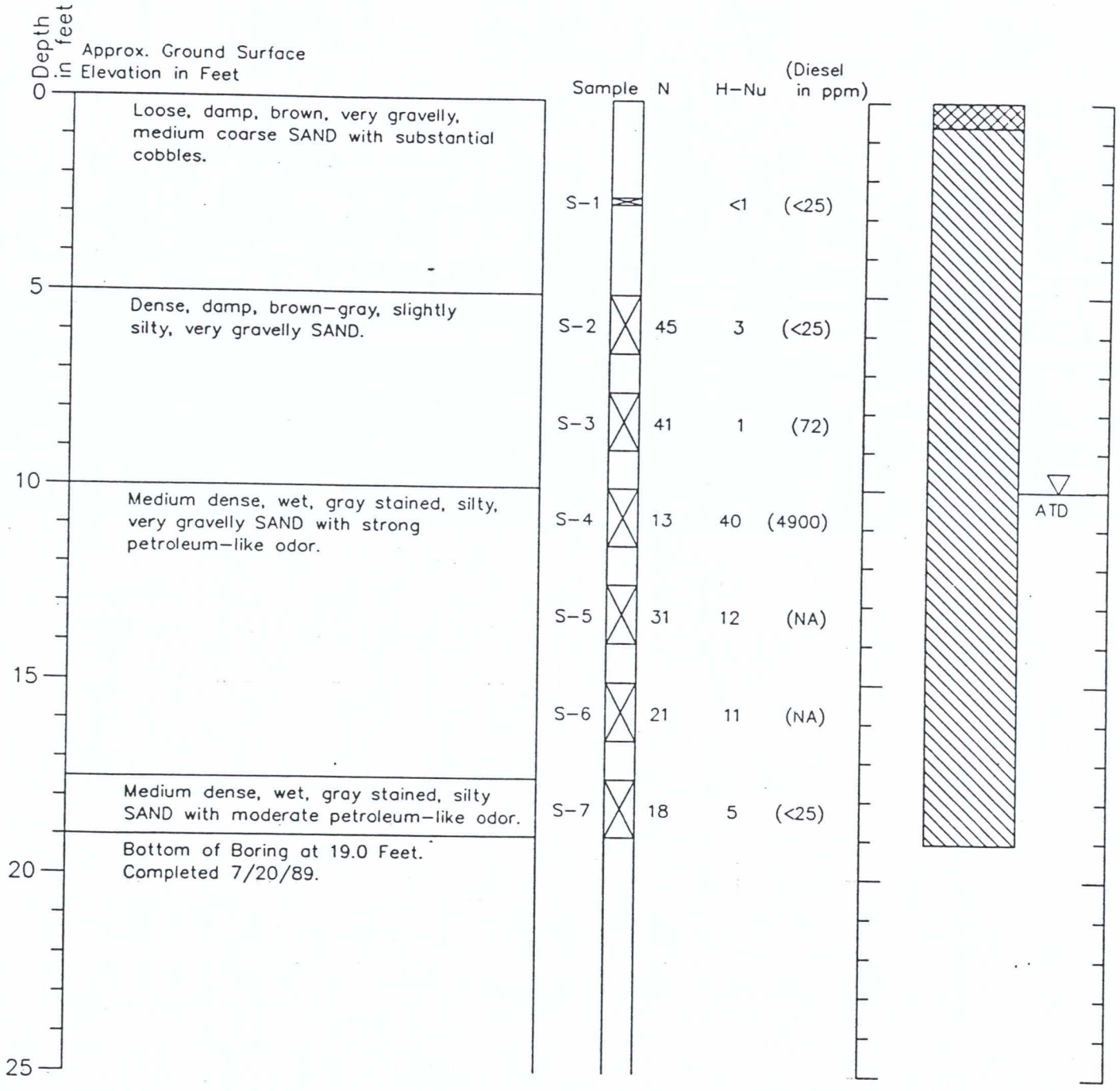
Figure 11

Boring Log B-10

Geologic Log



1. Refer to Figure 2 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
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Figure 12

Boring Log and Construction Data for Monitoring Well B-11

Geologic Log

Depth in feet

Approx. Ground Surface Elevation in Feet

0

Loose, damp, brown, very gravelly, medium to coarse SAND with substantial cobbles.

5

Medium damp, brown, slighlty silty SAND.

10

Dense, wet, gray stained, very gravelly SAND with strong petroleum-like odor and sheen.

15

Dense, wet, gray stained, silty, slightly gravelly SAND with slight petroleum-like odor.

20

Bottom of Boring at 19.0 Feet.
Completed 7/18/89.

25

Sample	N	H-Nu
S-1		<1
S-2	13	<1
S-3	32	2
S-4	37	26
S-5	21	24
S-6	21	14
S-7	8	7

Monitoring Well Design

Casing Stickup in Feet
Top of PVC in Feet 0.00

8/11/89

1. Refer to Figure 2 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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Figure 13